How Soon is Now?[1] Predicting the Expected Arrival Date of AGI (Artificial General Intelligence). Rupert Macey-Dare[2] Updated 27 September 2023[3]

Abstract

This paper uses some simple economic modelling techniques to predict the expected arrival date of AGI- Artificial General Intelligence[4]. The average predicted

[1] "How soon is now?" is a quote from George Elliot's (legal name: Mary Ann Evan's) celebrated 1871-2 novel Middlemarch (which deals inter alia with social change up to the Reform Act 1832, see: Wood M: "Middlemarch and the Rocky Road to the Reform Act of 1832" Library of Congress Blogs, 1 September 2017, at https://blogs.loc.gov/law/2017/09/middlemarch-and-the-rocky-road-to-the-reform-act-of-1832/)

See also Wikipedia: "How soon is now?" 2023 at https://en.wikipedia.org/wiki/How_Soon_Is_Now%3F and

Elliot G: "Middlemarch" Wordsworth Editions; New edition (5 Dec. 1993) at https://www.amazon.co.uk/Middlemarch-Wordsworth-Classics-George-Eliot/dp/1853262374 .

The Smiths famous 1980s song: "How soon is now?" at https://www.youtube.com/watch?v=hnpILIIo9ek was originally the vinyl disc B-side of their 1984 single "William, It Was Really Nothing". It combines futurist, mesmeric and apocalyptic music, written by guitarist Johnny Marr, perhaps suitable for a Terminatoresque AGI world, with opaque, angst-ridden, identity-crisis lyrics from lead singer Morrissey, and video images of post-industrial destruction and anonymous dancing.

(The paradoxical conceptual open question "How soon is now?" also seems to combine the concepts of past, present and future, change, waiting and uncertainty and imminence, that could apply to the cusp of AGI, and a potential "phase change" from pre to post AGI eras.)

(N.B. For a modern cover version explaining how the particular Smiths guitar sound may have been created, see also: Earwicker D: "COVER: The Smiths - How Soon Is Now" June 2007 at https://www.youtube.com/watch?v=SeE4mjS1BKM)

[2] Dr Rupert Macey-Dare LLM, see: https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=732884 and https://www.linkedin.com/in/rupertmaceydare/ . Draft paper subject to correction, review and revision. All comments and communication on this and other matters and cases gratefully received.

N.B. This paper is independent academic comment on evolving technology, and does not constitute and should not be read as specific advice. The author does not have any links, connections or affiliations with any parties mentioned below. Any calculations and examples are indicative and illustrative only.

[3] Original draft June 2023. For latest version see: https://ssrn.com/abstract=4496418

[4] See e.g. Wikipedia "Artificial general intelligence" 2023 at https://en.wikipedia.org/wiki/Artificial_general_intelligence and

Fei, N., Lu, Z., Gao, Y. et al. Towards artificial general intelligence via a multimodal foundation model. Nat Commun 13, 3094 (2022). https://doi.org/10.1038/s41467-022-30761-2

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date from this analysis is 2041, with a likely range of 2032 to 2048, and an estimated earliest possible arrival date of 2028, i.e. just 5 years away.

Whereas the average predicted date to get "reasonably close" to AGI is 2034, with a likely range of 2027 to 2041 and estimated earliest date of 2026, i.e. just 3 years away.[5]

(N.B. Significant global-scale conflict in the interim could delay this process, but probably not by more than 10 years.)

Together this implies that the next quarter century to mid 21stC is likely to see the arrival of AGI and all the challenges and risks this can bring to humanity including of existential and catastrophic change, which current and not just future generations of people will have to face and manage.

This study is therefore supportive of recent 2023 qualitative existential risk warnings from key godfathers of AI technology including: Hinton, Hassibis and Bengio[6]. Conversely, it is not supportive of those philosophers who dismiss AI existential risk claims as overblown[7] or diversionary, and find insuperable sticking points in abstract questions e.g. of AI consciousness[8] and AI qualia.

[5] This measure is implemented by estimating the time to get 50% of the way on the estimated growth paths from 0% to 100% AGI.

[6] See e.g. Vallance C: "Artificial intelligence could lead to extinction, experts warn" BBC Technology 30 May 2023 at https://www.bbc.co.uk/news/uk-65746524 and

Centre for AI Safety: "Statement on AI Risk- AI experts and public figures express their concern about AI risk" 2023 at https://www.safe.ai/statement-on-ai-risk and

Roose K: "A.I. Poses 'Risk of Extinction,' Industry Leaders Warn- Leaders from OpenAI, Google DeepMind, Anthropic and other A.I. labs warn that future systems could be as deadly as pandemics and nuclear weapons." New York Times 30 May 2023 at https://www.nytimes.com/2023/05/30/technology/ai-threat-warning.html

[7] See e.g. Eiskikovits N: "AI Is an Existential Threat—Just Not the Way You Think- Some fear that artificial intelligence will threaten humanity's survival. But the existential risk is more philosophical than apocalyptic" Scientific American 12 July 2023 at https://www.scientificamerican.com/article/ai-is-an-existential-threat-just-not-the-way-you-think/

[8] See e.g. McClelland T: "Will AI ever be conscious?" Clare College Cambridge 2022at https://stories.clare.cam.ac.uk/will-ai-ever-be-conscious/index.html

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Because the estimated arrival time of AGI, according to this analysis, is close by- in the next quarter century to mid 21stC, this will almost certainly occur before any planetary global warming emergency takes full effect[9]. And because AGI could include existential risk to humans, this leads to the conclusion and policy implication that AGI is probably the premier and most imminent potential existential risk to humanity, and therefore needs to be addressed most urgently and globally now.

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Introduction

This paper uses some simple economic modelling techniques to predict the expected arrival date of AGI- Artificial General Intelligence[10]. The average predicted date from this analysis is 2041, with a likely range of 2032 to 2048, and an estimated earliest possible arrival date of 2028, i.e. just 5 years away!

Whereas the average predicted date to get "reasonably close" to AGI is 2034, with a likely range of 2027 to 2041 and estimated earliest date of 2026, i.e. just 3 years away!

[9] See e.g. Tollefson J: "Climate change is hitting the planet faster than scientists originally thought- Latest IPCC climate report warns that rising greenhouse-gas emissions could soon outstrip the ability of many communities to adapt" Nature.com 28 February 2022 at https://www.nature.com/articles/d41586-022-00585-7

[10] The approach is essentially to use a family distribution of heuristic growth models generalizing the approach of Moore's Law.

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(N.B. Significant global-scale conflict in the interim could delay this process, but probably not by more than 10 years.)

Together this implies that the next quarter century to mid 21stC is likely to see the advent of AGI and all the challenges and risks this can bring to humanity including of existential and catastrophic change, which current and not just future generations of people will have to face and manage.

This study is therefore supportive of the recent 2023 qualitative existential risk warnings from key scientists involved in the technical hands-on development of AI technology to date including: Hinton, Hassibis and Bengio. Conversely, it is not supportive of philosophers who dismiss AI existential risk claims as overblown or diversionary, and find insuperable sticking points in abstract questions of AI consciousness and AI qualia.

Because the estimated arrival time of AGI is close by- in the next quarter century to mid 21stC, this will almost certainly occur before any planetary global warming emergency takes full effect. And because AGI could include existential risk to humans, this leads to the conclusion and policy implication that AGI is probably the premier and most imminent potential existential risk to humanity, and therefore needs to be addressed most urgently and globally now.

Analysis

A simple model that can be used to determine the likely arrival date of AGI- Artificial General Intelligence, under the conditional baseline assumption of no major war or major disruption in the interim which could cause significant delay, is a growth model with defined starting and end points and a growth path between the two.

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The starting point is where we are today in H1 2023, characterized by the release of the latest Generative AI LLM models[11]: ChatGPT, GPT4, Dall-e[12], Bard, Midjourney[13], etc.[14]

The end point is an unknown future date where commentators and analysts will generally agree that AGI- Artificial General Intelligence has been achieved. For these purposes the assumption is that this end point is where any purported AGI system typically always passes test intelligence and IQ tests (i.e. Turing Tests[15]).

If we use a proportional scale then the 1st question is how far along the path are we in 2023 towards AGI? Clearly we are beyond the start of the path given the exceptionally intelligent looking responses of the LLM systems above, but we are also clearly not at the end of the path, given the ability of analysts to fool these LLM systems with relatively simple conundrums (which might nevertheless also fool the average man on the bus).

[11] See e.g. Yenduri G et al "Generative Pre-trained Transformer: A Comprehensive Review on Enabling Technologies, Potential Applications, Emerging Challenges, and Future Directions" ArXiv.org May 2023 at https://arxiv.org/abs/2305.10435

[12] See OpenAI: "Pioneering research on the path to AGI" 2023 at https://openai.com/research/overview

[13] See Midjourney ai: "Text to image with AI Art Generator- Create awe-inspiring masterpieces effortlessly and explore the endless possibilities of AI generated art" 2023 at https://www.imagine.art/

[14] See e.g. Lutkevich B: "12 of the best large language models- Large language models have been affecting search for years and have been brought to the forefront by ChatGPT and other chatbots" Techtarget.com 14 July 2023 at https://www.techtarget.com/whatis/feature/12-of-the-best-large-language-models and

[15] See e.g. Wikipedia: "Intelligence quotient" [tests] 2023 at https://en.wikipedia.org/wiki/Intelligence_quotient and

Wikipedia: "Turing Test" 2023 at https://en.wikipedia.org/wiki/Turing_test and

Macey-Dare, Rupert, Could ChatGPT win the UK University Challenge and US College Bowl Competitions? Yes- Most Probably by KO. (February 19, 2023). Available at SSRN: https://ssrn.com/abstract=4364298 and

Macey-Dare, Rupert, Testing Generative AI's Apparent Theory of Mind, Empathy and Emotion, Personality & Voight-Kamff Scores using ChatGPT , LaMDA , Bard and Sydney, SSRN Forthcoming 2023

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So a conservative initial assumption could be that we are currently somewhere between 5% and 30% of the way along the path from no AGI to full AGI and so need to go between 3 to 20* further by an appropriate metric[16].

The next question is what is the likely speed of travel, future year by year along this path?

Clearly there was a long period of human history, say from 500,000 years ago until 1900 where one could argue that there was no mechanistic progress towards AGI, although advanced physics and mathematics discoveries were made, particularly towards the end of that period, that form the conceptual basis of AGI development. Similarly from 1900 to say 1960 and the development of the 1st electronic transistors, there was more fundamental research in the theory of computation and the development of large early mainframe computers. The period from 1960 to 2000 saw huge advances in computer chip technology and the development of high powered graphic chips, pcs and servers.

The period from 2000 to 2020 saw an explosion of IT telecoms and social network technology and networking of humans around the planet.

The period from 2020 to 2023+, even though stressed by Covid, has seen the public emergence of large language model LLM Generative AI systems including: ChatGPT, GPT4, Bard and in H1 2023 warnings from major scientists who have invented these potentially Frankenstein systems[17] of possible existential risk from them if unregulated development continues. Clearly these scientists see an imminent threat from the possibly imminent advent of AGI.

Taken together, this data suggests that we have been on and are still currently on an exponential growth path towards AGI.[18]

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[16] A likely implication is that looking back from the future say year 2200, we and/or thinking machines will then be able to accurately determine these dates and relevant growth path ex post.

[17] For the 19thC literary progenitor of this idea see: Shelley M: "Frankenstein" 1818 at https://www.amazon.co.uk/Frankenstein-Mary-Shelley/dp/1847493505

[18] See e.g. Vandermeer, J. (2010) How Populations Grow: The Exponential and Logistic Equations. Nature Education Knowledge 3(10) at https://www.nature.com/scitable/knowledge/library/how-populations-grow-the-exponential-and-logistic-13240157/

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This raises the question of what is the likely growth rate of this path? On the pure hardware constraints side Gordon Moore in the 1960s famously posited the heuristic law, called Moore's Law that computer chip power and processing speeds approximately doubles every 2 years. So if computer chip power was a limiting factor and Moore's Law still applied and computer chip power and processing speed fed through 1:1 into AGI development, then the expected growth factor along the AGI path would be doubling the distance towards the goal every 2 years[19].

If we accept that computer chip power is a potential constraint on AGI development, then this raises the question of whether Moore's Law will still hold over the near future as this will need the development of new nanoscale physics and technology development? This is unknown, but to date all such rolling objections have previously been overcome. Furthermore recent developments in quantum computing technology suggest that an order of magnitude increase in computing power from electronic computers is now reasonably close[20]. So it is a fair maintained assumption that Moore's Law will in fact still hold in the near term for computer power growth[21].

If we assume that there are no algorithmic constraints or that the computer algorithms used for prototype AGI systems will also develop at the comparable

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[19] See e.g. Wikipedia "Moore's Law" 2023 at https://en.wikipedia.org/wiki/Moore%27s_law and

Macey-Dare, Rupert, Economic Consequences of Moore's Law (May 20, 2013). Available at SSRN: https://ssrn.com/abstract=2261119

[20] See e.g. Castelvecchi D: "IBM quantum computer passes calculation milestone- 'Benchmark' experiment suggests quantum computers could have useful real-world applications within two years" Nature.com 14 June 2023 at https://www.nature.com/articles/d41586-023-01965-3

[21] See e.g. Nellis S: "Intel shows research for packing more computing power into chips beyond 2025" Reuters.com 11 December 2021 at https://www.reuters.com/technology/intel-shows-research-packing-more-computing-power-into-chips-beyond-2025-2021-12-11/ and

Wikipedia: " List of fastest computers" [by year] 2023 at https://en.wikipedia.org/wiki/List_of_fastest_computers and

Top500 "Top Supercomputers June 2023" at https://www.top500.org/lists/top500/2023/06/ and

Top500 "Top Supercomputers November 2010" at https://www.top500.org/lists/top500/2010/11/ and

Top500 "Top Supercomputers June 2000" at https://www.top500.org/lists/top500/list/2000/06/

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growth rates with the hardware, then the combined hardware and software systems should advance along the path towards AGI, at the Moore's Law rate. So in this paper we take the Moore's Law approximate growth rate of doubling in power every 2 years as an upper limit on the potential growth rate of AGI.

1. Thus if we assume starting now at 30% of the way to AGI, and a doubling of progress towards AGI every 2 years, then the expected time to full AGI would be only 2027 (Appendix column B)
2. If we assume starting now at 20% of the way to AGI, and a doubling of progress towards AGI every 2 years, then the expected time to full AGI would be only 2028 (Appendix column I)
3. If we assume starting now at 10% of the way to AGI, and a doubling of progress towards AGI every 2 years, then the expected time to full AGI would be only 2030 (Appendix column P)
4. If we assume starting now at 5% of the way to AGI, and a doubling of progress towards AGI every 2 years, then the expected time to full AGI would be only 2032 (Appendix column W)[22] [23]

[22] N.B. One key assumption of all these calculations is that AGI will happen a reasonable future time from now and so unlikely paths, where this could be either infinitely deferred or deferred ultra long term are ignored. Mathematically the reason for this is that unlikely but possible infinite time paths can cause expected average path times also to be infinite or huge, thus masking the shorter term data signal we are interested in uncovering.

Another key assumption is that there will not be a break where humanity suddenly stops growing towards AGI e.g. by ceasing all relevant computer research. As human efforts to get off a global warming path show, even if there is near-scientific-consensus about the problem and need for global action, nevertheless coordinating such action to avoid such a potential future global risk is geo-politically very hard to achieve.

See e.g. Intergovernmental Panel on Climate Change (IPCC): "AR6 Synthesis Report: Climate Change 2023-The IPCC finalized the Synthesis Report for the Sixth Assessment Report during the Panel's 58th Session held in Interlaken, Switzerland from 13 - 19 March 2023" at https://www.ipcc.ch/report/sixth-assessment-report-cycle/

[23] What this block of calculations generally shows is that with a high growth rate along the path to AGI, you get to AGI very quickly, from almost any starting point beyond the start of the graph.

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At the other extreme, a minimum growth rate on the path to AGI could be taken as 10% per 2 years or c.5% growth per year.

5. Thus if we assume starting now at 30% of the way to AGI, and just 10% growth towards AGI every 2 years, then the expected time to full AGI would be only 2049 (Appendix column F)
6. If we assume starting now at 20% of the way to AGI, and just 10% growth towards AGI every 2 years, then the expected time to full AGI would be only 2057 (Appendix column M)
7. If we assume starting now at 10% of the way to AGI, and just 10% growth towards AGI every 2 years, then the expected time to full AGI would be only 2072 (Appendix column T)
8. If we assume starting now at 5% of the way to AGI, and just 10% growth towards AGI every 2 years, then the expected time to full AGI would be only 2086 (Appendix column AA)[24]

Clearly these last figures look far too conservative, but they place an estimated latest absolute date on the advent of AGI, in the absence of any major disruption at 2086, i.e. well within 21st C.

Furthermore of we benchmark using WW1 and WW2 as natural experiments, then we can estimate that even a major global conflict, below the threshold of Armageddon, would probably only cause delay in AGI of up to 10 years[25]. Thus even with the lowest envisaged growth rates in AGI progress and major global conflict, the

[24] What this block of calculations generally shows is that the only way to defer getting to AGI reasonably quickly from now is to have a very low growth rate along the path to AGI.

[25] See e.g. O'Neill A: "Annual growth of real GDP in the United States of America from 1930 to 2021" Statistica January 2023 at https://www.statista.com/statistics/996758/rea-gdp-growth-united-states-1930-2019/ and

Statistica Research: "Change in gross domestic product (GDP) per capita in select regions of Europe from 1870 to 1950(as a share of 1900's GDP per capita)" Statistica December 2006 at https://www.statista.com/statistics/1076278/change-europe-region-gdp-per-capita-1870-1950-share-1900-rate/

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expected arrival date of AGI would still be within H2 of 21stC, so well within the lifetime of many current humans[26].

Results above set realistic lower and upper boundaries on the potential arrival date of AGI. However to get more central estimates we can ask what are plausible triple combinations of: i) starting distance to AGI now, ii) starting distance as a reasonable prior date, say 2010 and iii) reasonable growth rates of AGI:

9. Thus if we assume starting now at 30% of the way to AGI, and having been just 5% of the way to AGI in 2010, then this would be consistent with c. 30% growth rate towards AGI every 2 years, then the expected time to full AGI would be only 2033 (Appendix column D)
10. If we assume starting now at 20% of the way to AGI, and having been just 6% of the way to AGI in 2010, then this would be consistent with c. 20% growth rate towards AGI every 2 years, then the expected time to full AGI would be only 2041 (Appendix column L)
11. If we assume starting now at 10% of the way to AGI, and having been just 3% of the way to AGI in 2010, then this would be consistent with c. 20% growth rate towards AGI every 2 years, then the expected time to full AGI would be only 2049 (Appendix column S)
12. If we assume starting now at 5% of the way to AGI, and having been just 1.5% of the way to AGI in 2010, then this would be consistent with c. 20% growth rate towards AGI every 2 years, then the expected time to full AGI would be only 2056 (Appendix column Z)[27]

[26] See e.g. World Health Organization, Global Health Observatory: "GHE: Global Health Estimates- Life expectancy and healthy life expectancy" WHO 2023 at https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-life-expectancy-and-healthy-life-expectancy

[27] What this block of calculations generally shows is that many reasonable pairs of points along the growth path to AGI, today in 2023 and previously in 2010, appear to be consistent with growth rates every 2 years in the 20%-30% range. However these relatively high annual growth rates imply relatively quick arrival at full AGI under these models from now.

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However arguably humans are likely to be deeply impacted by AI technology well before full AGI is reached. If we assume that this significant impact point occurs at 50% of the way to full AGI, then we can also compute using these models the expected date of 50% AGI[28]:

13. Thus if we assume starting now at 30% of the way to AGI, and having been just 5% of the way to AGI in 2010, then this would be consistent with c. 30% growth rate towards AGI every 2 years, then the expected time to 50%-AGI would be only 2027 (Appendix column D)
14. If we assume starting now at 20% of the way to AGI, and having been just 6% of the way to AGI in 2010, then this would be consistent with c. 20% growth rate towards AGI every 2 years, then the expected time to 50%-AGI would be only 2033 (Appendix column L)
15. If we assume starting now at 10% of the way to AGI, and having been just 3% of the way to AGI in 2010, then this would be consistent with c. 20% growth rate towards AGI every 2 years, then the expected time to 50%-AGI would be only 2041 (Appendix column S)
16. If we assume starting now at 5% of the way to AGI, and having been just 1.5% of the way to AGI in 2010, then this would be consistent with c. 20% growth rate towards AGI every 2 years, then the expected time to 50%-AGI would be only 2049 (Appendix column Z)

From these possible paths, we can select 4 reasonable paths corresponding to starting at 30%, 20%, 10% and 5% of the way towards full AGI in 2023 plus a reasonable path consistent with a Moore's Law growth rate, as follows:

[28] This is an indicative but arbitrary level. The idea is to choose an obvious focal percentage value where AGI has not been achieved but AI systems developing towards AGI are dominating human lives globally (just as say Facebook and mobile telecoms technology dominate human lives globally today.)

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	Assumption 2023 % distance to AGI	Assumption 2010 % distance to AGI	Est date 50% AGI	Estimated datefull AGI	Growth factor per 2 years
Reasonable path 1	30.0%	5.5%	2027	2032	1.30
Reasonable path 2	20.0%	6.1%	2033	2041	1.20
Reasonable path 3	10.0%	3.1%	2041	2048	1.20
Earliest reasonable path (assuming recent step-up in growth rate to Moore's Law rate)	20.0%		2026	2028	2
Latest reasonable path	5.0%	1.5%	2048	2056	1.2

We can then do some simple analysis looking at the distribution of data for these selected paths to produce the following table[29]:

	Growth rate/ 2 years	Est % distance to AGI in 2010	Est date 50% AGI	Estimated date AGI	Growth factor per 2 years
Max	30.0%	6.1%	2048	2056	2.00
Q3	20.0%	5.6%	2041	2048	1.30
Median	20.0%	4.3%	2033	2041	1.20
Ave	17.0%	4.0%	2035	2041	1.38
Q1	10.0%	2.7%	2027	2032	1.20
Min	5.0%	1.5%	2026	2028	1.20

This leads to the following highlight results for the selected potential plausible growth paths:

17. The expected date of full-AGI is 2041 i.e. less than 20 years away
18. The interquartile range of expected date of full-AGI is 2032 i.e. less than 10 years away to 2048
19. The earliest expected date for full-AGI is 2028 i.e. only 5 years away.
20. The latest expected date for full-AGI is 2056 i.e. c.30 years away.

The results are even starker for 50%-AGI, where it is envisaged that all human lives will be dominated by AI:

[29] N.B. Each column in this table needs to be viewed on its own and so data is not mutually consistent on a row by row basis. To illustrate the maximum growth rate per 2 years is 2*, but this leads to the minimum rather than maximum time to 50% and full AGI, as growth rate and time to AGI are inversely rather than positively related.

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21. The expected date of 50%-AGI is 2034 i.e. c.10 years away
22. The interquartile range of expected dates of 50%-AGI is 2027 i.e. just 4 years away to 2041
23. The earliest expected date for 50%-AGI is 2026 i.e. only 3 years away.
24. The latest expected date for 50%-AGI is 2048 i.e. c.25 years away

We can also do some simple analysis looking at the distribution of data for these selected paths, assuming a major (but sub-Armageddon) shock[30] to produce the following table:

	Growth rate/ 2 years	Est % distance to AGI in 2010	Growth factor per 2 years	50% AGI With major shock	AGI With major shock
Max	30.0%	6.1%	2.00	2058	2066
Q3	20.0%	5.6%	1.30	2051	2058
Median	20.0%	4.3%	1.20	2043	2051
Ave	17.0%	4.0%	1.38	2045	2051
Q1	10.0%	2.7%	1.20	2037	2042
Min	5.0%	1.5%	1.20	2036	2038

This leads to the following highlight results for the selected potential plausible growth paths, even with a major (but sub-Armageddon) shock causing delay:

25. The expected date of full-AGI assuming a delay shock is 2051 i.e. less than 30 years away
26. The interquartile range of expected date of full-AGI is 2042 i.e. less than 20 years away to 2058
27. The earliest expected date for full-AGI is 2038 i.e. only 15 years away.
28. The latest expected date for full-AGI is 2066 i.e. c.40 years away.

[30] This is assumed to add 10 years to the time path to AGI. Arguably the experience of WW1 and WW2 to the degree relevant, was that even huge global war shocks failed to hold up global growth by this amount of time and even stimulated technological progress in a technological arms race. So this is a conservative modelling assumption, potentially prone to add delay bias to the estimated time of AGI.

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The results are even starker for 50%-AGI, where it is envisaged that all human lives will be dominated by AI, even with a major (but sub-Armageddon) shock causing delay:

29. The expected date of 50%-AGI assuming a delay shock is 2044 i.e. c.20 years away
30. The interquartile range of expected dates of 50%-AGI assuming a delay shock is 2037 i.e. just 14 years away to 2051
31. The earliest expected date for 50%-AGI assuming a delay shock is 2036 i.e. only 13 years away.
32. The latest expected date for 50%-AGI assuming a delay shock is 2058 i.e. c.35 years away

If we exclude the Moore's Law growth path of AGI as too high, (although this is debatable), then we are left with the following paths:

	Assumption 2023 % distance to AGI	Assumption 2010 % distance to AGI	Est date 50% AGI	Estimated datefull AGI	Growth factor per 2 years
Reasonable path 1	30.0%	5.5%	2027	2032	1.30
Reasonable path 2	20.0%	6.1%	2033	2041	1.20
Reasonable path 3	10.0%	3.1%	2041	2048	1.20
Latest reasonable path	5.0%	1.5%	2048	2056	1.2

We can then do some simple analysis looking at the distribution of data for these selected paths to produce the following table.

	Growth rate/ 2 years	Est % distance to AGI in 2010	Est date 50% AGI	Estimated date AGI	Growth factor per 2 years
Max	30.0%	6.1%	2048	2056	1.30
Q3	22.5%	5.6%	2043	2050	1.23
Median	15.0%	4.3%	2037	2045	1.20
Ave	16.3%	4.0%	2037	2044	1.23
Q1	8.8%	2.7%	2032	2039	1.20
Min	5.0%	1.5%	2027	2032	1.20

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This leads to the following highlight results for the selected potential plausible growth paths:

33. The expected date of full-AGI is 2044 i.e. c.20 years away
34. The interquartile range of expected date of full-AGI is 2039 to 2050
35. The earliest expected date for full-AGI is 2032 i.e. less than 10 years away.
36. The latest expected date for full-AGI is 2056 i.e. c.30 years away.

The results are even starker for 50%-AGI, where it is envisaged that all human lives will be dominated by AI:

37. The expected date of 50%-AGI is 2037 i.e. c.14 years away
38. The interquartile range of expected dates of 50%-AGI is 2032 i.e. less than 10 years away to 2043
39. The earliest expected date for 50%-AGI is 2027 i.e. only 4 years away.
40. The latest expected date for 50%-AGI is 2048 i.e. c.25 years away

If we additionally exclude the growth path of AGI starting at 5% along the AGI path now, as too low, then we are left with the following paths:

	Assumption 2023 % distance to AGI	Assumption 2010 % distance to AGI	Est date 50% AGI	Estimated datefull AGI	Growth factor per 2 years
Reasonable path 1	30.0%	5.5%	2027	2032	1.30
Reasonable path 2	20.0%	6.1%	2033	2041	1.20
Reasonable path 3	10.0%	3.1%	2041	2048	1.20

We can then do some simple analysis looking at the distribution of data for these selected paths to produce the following table:

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	Growth rate/ 2 years	Est % distance to AGI in 2010	Est date 50% AGI	Estimated date AGI	Growth factor per 2 years
Max	30.0%	6.1%	2041	2048	1.30
Q3	25.0%	5.8%	2037	2045	1.25
Median	20.0%	5.5%	2033	2041	1.20
Ave	20.0%	4.9%	2034	2040	1.23
Q1	15.0%	4.3%	2030	2037	1.20
Min	10.0%	3.1%	2027	2032	1.20

This leads to the following highlight results for the selected potential plausible growth paths:

41. The expected date of full-AGI is 2040 i.e. c.17 years away
42. The interquartile range of expected date of full-AGI is 2037 to 2045
43. The earliest expected date for full-AGI is 2032 i.e. less than 10 years away.
44. The latest expected date for full-AGI is 2048 i.e. c.25 years away.

The results are even starker for 50%-AGI, where it is envisaged that all human lives will be dominated by AI:

45. The expected date of 50%-AGI is 2034 i.e. c.10 years away
46. The interquartile range of expected dates of 50%-AGI is 2030 i.e. 7 years away to 2037
47. The earliest expected date for 50%-AGI is 2027 i.e. only 4 years away.
48. The latest expected date for 50%-AGI is 2041 i.e. less than 20 years away

Conclusion

This analysis makes the following basic assumptions, based on extrapolating and inductive thinking, from current knowledge:

- AGI- Artificial General Intelligence will happen in a finite number of years from now
- The date when AGI happens will be observable at the time
- The date when AGI happens will also be known ex post

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- The date when AGI happens will not be known ex ante, but will be predictable ex ante
- We are some unknown finite distance along the time path from no AI to full AGI
- We are some unknown finite distance along the development path from no AI to full AGI
- Our progress along this development path will have an average exponential growth rate per year.
- However this average exponential growth rate per year is unknown ex ante.
- Our starting point in 2023 along the development path from no AI to full AGI is unknown but can be reasonably estimated within certain ranges
- The average exponential growth rate per year, from 2023 onwards, along the development path from no AI to full AGI is unknown but can be reasonably estimated within certain ranges
- Thus a range of plausible growth path scenarios can be modelled from 2023 onwards, along the development path from no AI to full AGI
- These plausible growth path scenarios along the development path from no AI to full AGI can be combined into a set of scenarios, producing a distribution of plausible possible outcomes.
- This distribution of possible outcomes can be used to produce an estimated expected plausible growth path along the development path from no AI to full AGI and distribution of expected bounding paths.
- A similar approach can be used to produce an estimated expected plausible growth path along the development path from no AI to 50%-AGI and distribution of expected bounding paths.
- This distribution of possible outcomes can also be used to produce an estimated expected plausible growth path along the development path from no AI to full AGI and distribution of expected bounding paths, on the additional assumption of major global shock (but below Armageddon level).

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Date posted: July 05, 2023 ; **Last revised:** September 09, 2023

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Appendix: Alternative scenario growth paths towards AGI
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	Growth rate/ 2 years	Est % distance to AGI in 2010	Est date 50% AGI	Estimated date AGI	Growth factor per 2 years	50% AGI With major shock	AGI With major shock	10
Max	30.0%	6.1%	2045	2056	2.00	2058	2066	
Q3	20.0%	5.6%	2041	2048	1.30	2051	2058	
Median	20.0%	4.3%	2033	2041	1.20	2043	2051	
Ave	17.0%	4.0%	2035	2041	1.38	2045	2051	
Q1	10.0%	2.7%	2027	2032	1.20	2037	2042	
Min	5.0%	1.5%	2026	2028	1.20	2036	2038	

	Assumption 2023 % distance to AGI	Assumption 2010 % distance to AGI	Est date 50% AGI	Estimated datefull AGI	Growth factor per 2 years
Reasonable path 1	30.0%	5.5%	2027	2032	1.30
Reasonable path 2	20.0%	6.1%	2033	2041	1.20
Reasonable path 3	10.0%	3.1%	2041	2048	1.20
Earliest reasonable path (assuming recent step-up in growth rate to Moore's Law rate)	20.0%		2026	2028	2
Latest reasonable path	5.0%	1.5%	2048	2056	1.2

Years Offset	0				
Growth/2 years	2	1.5	1.3	1.2	1.1

	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI
2010	0.3%	2.2%	5.5%	9.2%	16.1%
2011	0.5%	2.6%	6.2%	10.0%	16.9%
2012	0.7%	3.2%	7.1%	11.0%	17.8%
2013	0.9%	4.0%	8.1%	12.1%	18.6%
2014	1.3%	4.8%	9.2%	13.2%	19.5%
2015	1.9%	5.9%	10.5%	14.5%	20.5%
2016	2.7%	7.3%	12.0%	15.8%	21.5%
2017	3.8%	8.9%	13.7%	17.4%	22.5%
2018	5.3%	10.9%	15.6%	19.0%	23.6%
2019	7.5%	13.3%	17.8%	20.8%	24.8%
2020	10.6%	16.3%	20.2%	22.8%	26.0%
2021	15.0%	20.0%	23.1%	25.0%	27.3%
2022	21.2%	24.5%	26.3%	27.4%	28.6%
2023	30.0%	30.0%	30.0%	30.0%	30.0%
2024	42.4%	36.7%	34.2%	32.9%	31.5%
2025	60.0%	45.0%	39.0%	36.0%	33.0%
2026	84.9%	55.1%	44.5%	39.4%	34.6%
2027	120.0%	67.5%	50.7%	43.2%	36.3%
2028	169.7%	82.7%	57.8%	47.3%	38.1%
2029	240.0%	101.3%	65.9%	51.8%	39.9%
2030	339.4%	124.0%	75.1%	56.8%	41.9%
2031	480.0%	151.9%	85.7%	62.2%	43.9%
2032	678.8%	186.0%	97.7%	68.1%	46.1%
2033	960.0%	227.8%	111.4%	74.6%	48.3%
2034	1357.6%	279.0%	127.0%	81.8%	50.7%
2035	1920.0%	341.7%	144.8%	89.6%	53.1%
2036	2715.3%	418.5%	165.1%	98.1%	55.7%
2037	3840.0%	512.6%	188.2%	107.5%	58.5%
2038	5430.6%	627.8%	214.6%	117.8%	61.3%
2039	7680.0%	768.9%	244.7%	129.0%	64.3%
2040	10861.2%	941.7%	279.0%	141.3%	67.4%
2041	15360.0%	1153.3%	318.1%	154.8%	70.7%
2042	21722.3%	1412.5%	362.7%	169.6%	74.2%
2043	30720.0%	1730.0%	413.6%	185.8%	77.8%
2044	43444.6%	2118.7%	471.5%	203.5%	81.6%
2045	61440.0%	2594.9%	537.6%	222.9%	85.6%
2046	86889.3%	3178.1%	613.0%	244.2%	89.8%
2047	122880.0%	3892.4%	698.9%	267.5%	94.2%
2048	173778.6%	4767.2%	796.9%	293.0%	98.7%
2049	245760.0%	5838.6%	908.6%	321.0%	103.6%
2050	347557.1%	7150.8%	1036.0%	351.6%	108.6%
2051	491520.0%	8757.9%	1181.2%	385.2%	113.9%
2052	695114.3%	10726.2%	1346.8%	421.9%	119.5%
2053	983040.0%	13136.8%	1535.6%	462.2%	125.3%
2054	1390228.5%	16089.2%	1750.8%	506.3%	131.4%
2055	1966080.0%	19705.2%	1996.2%	554.7%	137.8%
2056	2780457.0%	24133.9%	2276.1%	607.6%	144.6%
2057	3932160.0%	29557.8%	2595.1%	665.6%	151.6%
2058	5560914.0%	36200.8%	2958.9%	729.1%	159.0%
2059	7864320.0%	44336.8%	3373.7%	798.7%	166.8%
2060	11121828.0%	54301.2%	3846.6%	874.9%	174.9%
2061	15728640.0%	66505.1%	4385.8%	958.4%	183.5%
2062	22243656.0%	81451.8%	5000.5%	1049.9%	192.4%
2063	31457280.0%	99757.7%	5701.5%	1150.1%	201.8%
2064	44487312.0%	122177.7%	6500.7%	1259.9%	211.7%
2065	62914560.0%	149636.6%	7411.9%	1380.2%	222.0%
2066	88974624.0%	183266.6%	8450.9%	1511.9%	232.8%
2067	125829120.0%	224454.8%	9635.5%	1656.2%	244.2%
2068	177949248.0%	274899.9%	10986.2%	1814.3%	256.1%
2069	251658240.0%	336682.2%	12526.2%	1987.4%	268.6%
2070	355898496.1%	412349.9%	14282.0%	2177.1%	281.7%
2071	503316480.0%	505023.4%	16284.0%	2384.9%	295.5%
2072	711796992.2%	618524.8%	18566.6%	2612.5%	309.9%
2073	1006632960.0%	757535.0%	21169.2%	2861.9%	325.0%
2074	1423593984.4%	927787.2%	24136.6%	3135.0%	340.9%
2075	2013265920.0%	1136302.6%	27520.0%	3434.3%	357.5%
2076	2847187968.7%	1391680.7%	31377.6%	3762.0%	375.0%
2077	4026531840.0%	1704453.9%	35776.0%	4121.1%	393.3%
2078	5694375937.5%	2087521.1%	40790.9%	4514.5%	412.5%
2079	8053063680.0%	2556680.8%	46508.8%	4945.3%	432.6%
2080	11388751874.0%	3131281.5%	53028.2%	5417.3%	453.7%
2081	16106127360.0%	3835021.2%	60461.4%	5934.4%	475.9%
2082	22777503749.8%	4696922.5%	68936.6%	6500.8%	499.1%
2083	32212254720.0%	5752531.8%	78599.9%	7121.3%	523.5%
2084	45555007499.6%	7045383.8%	89617.6%	7801.0%	549.0%
2085	64424509440.0%	8628797.7%	102179.8%	8545.5%	575.8%
2086	91110014999.3%	10568075.7%	116502.9%	9361.2%	603.9%
2087	128849018880.0%	12943196.5%	132833.8%	10254.7%	633.4%
2088	182220029998.6%	15852113.5%	151453.8%	11233.4%	664.3%
2089	257698037760.0%	19414794.7%	172683.9%	12305.6%	696.8%
2090	364440059997.1%	23778170.3%	196890.0%	13480.1%	730.8%
2091	515396075520.0%	29122192.1%	224489.1%	14766.7%	766.4%
2092	728880119994.3%	35667255.4%	255956.9%	16176.1%	803.8%
2093	1030792151040.0%	43683288.2%	291835.8%	17720.0%	843.1%
2094	1457760239988.5%	53500883.2%	332744.0%	19411.3%	884.2%
2095	2061584302080.0%	65524932.3%	379386.6%	21264.1%	927.4%
2096	2915520479977.0%	80251324.7%	432567.2%	23293.6%	972.6%
2097	4123168604160.0%	98287398.4%	493202.5%	25516.9%	1020.1%
2098	5831040959954.0%	120376987.1%	562337.4%	27952.3%	1069.9%
2099	8246337208320.0%	147431097.6%	641163.3%	30620.2%	1122.1%
2100	11662081919908.0%	180565480.7%	731038.6%	33542.8%	1176.9%

Years Offset	0				
Growth/2 years	2	1.5	1.3	1.2	1.1

	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI
2010	0.2%	1.4%	3.6%	6.1%	10.8%
2011	0.3%	1.8%	4.1%	6.7%	11.3%
2012	0.4%	2.2%	4.7%	7.3%	11.8%
2013	0.6%	2.6%	5.4%	8.0%	12.4%
2014	0.9%	3.2%	6.1%	8.8%	13.0%
2015	1.3%	4.0%	7.0%	9.6%	13.7%
2016	1.8%	4.8%	8.0%	10.6%	14.3%
2017	2.5%	5.9%	9.1%	11.6%	15.0%
2018	3.5%	7.3%	10.4%	12.7%	15.8%
2019	5.0%	8.9%	11.8%	13.9%	16.5%
2020	7.1%	10.9%	13.5%	15.2%	17.3%
2021	10.0%	13.3%	15.4%	16.7%	18.2%
2022	14.1%	16.3%	17.5%	18.3%	19.1%
2023	20.0%	20.0%	20.0%	20.0%	20.0%
2024	28.3%	24.5%	22.8%	21.9%	21.0%
2025	40.0%	30.0%	26.0%	24.0%	22.0%
2026	56.6%	36.7%	29.6%	26.3%	23.1%
2027	80.0%	45.0%	33.8%	28.8%	24.2%
2028	113.1%	55.1%	38.5%	31.5%	25.4%
2029	160.0%	67.5%	43.9%	34.6%	26.6%
2030	226.3%	82.7%	50.1%	37.9%	27.9%
2031	320.0%	101.3%	57.1%	41.5%	29.3%
2032	452.5%	124.0%	65.1%	45.4%	30.7%
2033	640.0%	151.9%	74.3%	49.8%	32.2%
2034	905.1%	186.0%	84.7%	54.5%	33.8%
2035	1280.0%	227.8%	96.5%	59.7%	35.4%
2036	1810.2%	279.0%	110.1%	65.4%	37.2%
2037	2560.0%	341.7%	125.5%	71.7%	39.0%
2038	3620.4%	418.5%	143.1%	78.5%	40.9%
2039	5120.0%	512.6%	163.1%	86.0%	42.9%
2040	7240.8%	627.8%	186.0%	94.2%	45.0%
2041	10240.0%	768.9%	212.1%	103.2%	47.2%
2042	14481.5%	941.7%	241.8%	113.0%	49.5%
2043	20480.0%	1153.3%	275.7%	123.8%	51.9%
2044	28963.1%	1412.5%	314.4%	135.7%	54.4%
2045	40960.0%	1730.0%	358.4%	148.6%	57.1%
2046	57926.2%	2118.7%	408.7%	162.8%	59.8%
2047	81920.0%	2594.9%	466.0%	178.3%	62.8%
2048	115852.4%	3178.1%	531.3%	195.3%	65.8%
2049	163840.0%	3892.4%	605.8%	214.0%	69.0%
2050	231704.8%	4767.2%	690.7%	234.4%	72.4%
2051	327680.0%	5838.6%	787.5%	256.8%	75.9%
2052	463409.5%	7150.8%	897.9%	281.3%	79.7%
2053	655360.0%	8757.9%	1023.7%	308.1%	83.5%
2054	926819.0%	10726.2%	1167.2%	337.6%	87.6%
2055	1310720.0%	13136.8%	1330.8%	369.8%	91.9%
2056	1853638.0%	16089.2%	1517.4%	405.1%	96.4%
2057	2621440.0%	19705.2%	1730.1%	443.7%	101.1%
2058	3707276.0%	24133.9%	1972.6%	486.1%	106.0%
2059	5242880.0%	29557.8%	2249.1%	532.5%	111.2%
2060	7414552.0%	36200.8%	2564.4%	583.3%	116.6%
2061	10485760.0%	44336.8%	2923.8%	639.0%	122.3%
2062	14829104.0%	54301.2%	3333.7%	699.9%	128.3%
2063	20971520.0%	66505.1%	3801.0%	766.8%	134.5%
2064	29658208.0%	81451.8%	4333.8%	839.9%	141.1%
2065	41943040.0%	99757.7%	4941.3%	920.1%	148.0%
2066	59316416.0%	122177.7%	5633.9%	1007.9%	155.2%
2067	83886080.0%	149636.6%	6423.7%	1104.1%	162.8%
2068	118632832.0%	183266.6%	7324.1%	1209.5%	170.8%
2069	167772160.0%	224454.8%	8350.8%	1324.9%	179.1%
2070	237265664.1%	274899.9%	9521.4%	1451.4%	187.8%
2071	335544320.0%	336682.2%	10856.0%	1589.9%	197.0%
2072	474531328.1%	412349.9%	12377.8%	1741.7%	206.6%
2073	671088640.0%	505023.4%	14112.8%	1907.9%	216.7%
2074	949062656.2%	618524.8%	16091.1%	2090.0%	227.3%
2075	1342177280.0%	757535.0%	18346.7%	2289.5%	238.4%
2076	1898125312.5%	927787.2%	20918.4%	2508.0%	250.0%
2077	2684354560.0%	1136302.6%	23850.7%	2747.4%	262.2%
2078	3796250625.0%	1391680.7%	27193.9%	3009.6%	275.0%
2079	5368709120.0%	1704453.9%	31005.9%	3296.9%	288.4%
2080	7592501249.9%	2087521.1%	35352.1%	3611.6%	302.5%
2081	10737418240.0%	2556680.8%	40307.6%	3956.3%	317.3%
2082	15185002499.9%	3131281.7%	45957.8%	4333.9%	332.7%
2083	21474836480.0%	3835021.2%	52399.9%	4747.5%	349.0%
2084	30370004999.8%	4696922.5%	59745.1%	5200.7%	366.0%
2085	42949672960.0%	5752531.8%	68119.9%	5697.0%	383.9%
2086	60740009999.5%	7045383.8%	77668.6%	6240.8%	402.6%
2087	85899345920.0%	8628797.7%	88555.9%	6836.4%	422.3%
2088	121480019999.0%	10568075.7%	100969.2%	7488.9%	442.9%
2089	171798691840.0%	12943196.5%	115122.6%	8203.7%	464.5%
2090	242960039998.1%	15852113.5%	131260.0%	8986.7%	487.2%
2091	343597383680.0%	19414794.7%	149659.4%	9844.5%	511.0%
2092	485920079996.2%	23778170.3%	170638.0%	10784.1%	535.9%
2093	687194767360.0%	29122192.1%	194557.2%	11813.4%	562.0%
2094	971840159992.3%	35667255.4%	221829.3%	12940.9%	589.5%
2095	1374389534720.0%	43683288.2%	252924.4%	14176.0%	618.3%
2096	1943680319984.7%	53500883.2%	288378.2%	15529.1%	648.4%
2097	2748779069440.0%	65524932.3%	328801.7%	17011.2%	680.1%
2098	3887360639969.3%	80251324.7%	374891.6%	18634.9%	713.3%
2099	5497558138880.0%	98287398.4%	427442.2%	20413.5%	748.1%
2100	7774721279938.7%	120376987.1%	487359.1%	22361.9%	784.6%

Years Offset	0				
Growth/2 years	2	1.5	1.3	1.2	1.1

	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI
2010	0.1%	0.7%	1.8%	3.1%	5.4%
2011	0.2%	0.9%	2.1%	3.3%	5.6%
2012	0.2%	1.1%	2.4%	3.7%	5.9%
2013	0.3%	1.3%	2.7%	4.0%	6.2%
2014	0.4%	1.6%	3.1%	4.4%	6.5%
2015	0.6%	2.0%	3.5%	4.8%	6.8%
2016	0.9%	2.4%	4.0%	5.3%	7.2%
2017	1.3%	3.0%	4.6%	5.8%	7.5%
2018	1.8%	3.6%	5.2%	6.3%	7.9%
2019	2.5%	4.4%	5.9%	6.9%	8.3%
2020	3.5%	5.4%	6.7%	7.6%	8.7%
2021	5.0%	6.7%	7.7%	8.3%	9.1%
2022	7.1%	8.2%	8.8%	9.1%	9.5%
2023	10.0%	10.0%	10.0%	10.0%	10.0%
2024	14.1%	12.2%	11.4%	11.0%	10.5%
2025	20.0%	15.0%	13.0%	12.0%	11.0%
2026	28.3%	18.4%	14.8%	13.1%	11.5%
2027	40.0%	22.5%	16.9%	14.4%	12.1%
2028	56.6%	27.6%	19.3%	15.8%	12.7%
2029	80.0%	33.8%	22.0%	17.3%	13.3%
2030	113.1%	41.3%	25.0%	18.9%	14.0%
2031	160.0%	50.6%	28.6%	20.7%	14.6%
2032	226.3%	62.0%	32.6%	22.7%	15.4%
2033	320.0%	75.9%	37.1%	24.9%	16.1%
2034	452.5%	93.0%	42.3%	27.3%	16.9%
2035	640.0%	113.9%	48.3%	29.9%	17.7%
2036	905.1%	139.5%	55.0%	32.7%	18.6%
2037	1280.0%	170.9%	62.7%	35.8%	19.5%
2038	1810.2%	209.3%	71.5%	39.3%	20.4%
2039	2560.0%	256.3%	81.6%	43.0%	21.4%
2040	3620.4%	313.9%	93.0%	47.1%	22.5%
2041	5120.0%	384.4%	106.0%	51.6%	23.6%
2042	7240.8%	470.8%	120.9%	56.5%	24.7%
2043	10240.0%	576.7%	137.9%	61.9%	25.9%
2044	14481.5%	706.2%	157.2%	67.8%	27.2%
2045	20480.0%	865.0%	179.2%	74.3%	28.5%
2046	28963.1%	1059.4%	204.3%	81.4%	29.9%
2047	40960.0%	1297.5%	233.0%	89.2%	31.4%
2048	57926.2%	1589.1%	265.6%	97.7%	32.9%
2049	81920.0%	1946.2%	302.9%	107.0%	34.5%
2050	115852.4%	2383.6%	345.3%	117.2%	36.2%
2051	163840.0%	2919.3%	393.7%	128.4%	38.0%
2052	231704.8%	3575.4%	448.9%	140.6%	39.8%
2053	327680.0%	4378.9%	511.9%	154.1%	41.8%
2054	463409.5%	5363.1%	583.6%	168.8%	43.8%
2055	655360.0%	6568.4%	665.4%	184.9%	45.9%
2056	926819.0%	8044.6%	758.7%	202.5%	48.2%
2057	1310720.0%	9852.6%	865.0%	221.9%	50.5%
2058	1853638.0%	12066.9%	986.3%	243.0%	53.0%
2059	2621440.0%	14778.9%	1124.6%	266.2%	55.6%
2060	3707276.0%	18100.4%	1282.2%	291.6%	58.3%
2061	5242880.0%	22168.4%	1461.9%	319.5%	61.2%
2062	7414552.0%	27150.6%	1666.8%	350.0%	64.1%
2063	10485760.0%	33252.6%	1900.5%	383.4%	67.3%
2064	14829104.0%	40725.9%	2166.9%	420.0%	70.6%
2065	20971520.0%	49878.9%	2470.6%	460.1%	74.0%
2066	29658208.0%	61088.9%	2817.0%	504.0%	77.6%
2067	41943040.0%	74818.3%	3211.8%	552.1%	81.4%
2068	59316416.0%	91633.3%	3662.1%	604.8%	85.4%
2069	83886080.0%	112227.4%	4175.4%	662.5%	89.5%
2070	118632832.0%	137450.0%	4760.7%	725.7%	93.9%
2071	167772160.0%	168341.1%	5428.0%	795.0%	98.5%
2072	237265664.1%	206174.9%	6188.9%	870.8%	103.3%
2073	335544320.0%	252511.7%	7056.4%	954.0%	108.3%
2074	474531328.1%	309262.4%	8045.5%	1045.0%	113.6%
2075	671088640.0%	378767.5%	9173.3%	1144.8%	119.2%
2076	949062656.2%	463893.6%	10459.2%	1254.0%	125.0%
2077	1342177280.0%	568151.3%	11925.3%	1373.7%	131.1%
2078	1898125312.5%	695840.4%	13597.0%	1504.8%	137.5%
2079	2684354560.0%	852226.9%	15502.9%	1648.4%	144.2%
2080	3796250625.0%	1043760.6%	17676.1%	1805.8%	151.2%
2081	5368709120.0%	1278340.4%	20153.8%	1978.1%	158.6%
2082	7592501249.9%	1565640.8%	22978.9%	2166.9%	166.4%
2083	10737418240.0%	1917510.6%	26200.0%	2373.8%	174.5%
2084	15185002499.9%	2348461.3%	29872.5%	2600.3%	183.0%
2085	21474836480.0%	2876265.9%	34059.9%	2848.5%	191.9%
2086	30370004999.8%	3522691.9%	38834.3%	3120.4%	201.3%
2087	42949672960.0%	4314398.8%	44277.9%	3418.2%	211.1%
2088	60740009999.5%	5284037.8%	50484.6%	3744.5%	221.4%
2089	85899345920.0%	6471598.2%	57561.3%	4101.9%	232.3%
2090	121480019999.0%	7926056.8%	65630.0%	4493.4%	243.6%
2091	171798691840.0%	9707397.4%	74829.7%	4922.2%	255.5%
2092	242960039998.1%	11890085.1%	85319.0%	5392.0%	267.9%
2093	343597383680.0%	14561096.1%	97278.6%	5906.7%	281.0%
2094	485920079996.2%	17833627.7%	110914.7%	6470.4%	294.7%
2095	687194767360.0%	21841644.1%	126462.2%	7088.0%	309.1%
2096	971840159992.3%	26750441.6%	144189.1%	7764.5%	324.2%
2097	1374389534720.0%	32762466.1%	164400.8%	8505.6%	340.0%
2098	1943680319984.7%	40125662.4%	187445.8%	9317.4%	356.6%
2099	2748779069440.0%	49143699.2%	213721.1%	10206.7%	374.0%
2100	3887360639969.3%	60188493.6%	243679.5%	11180.9%	392.3%

Years Offset	0				
Growth/2 years	2	1.5	1.3	1.2	1.1

	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI	Progress towards AGI
2010	0.1%	0.4%	0.9%	1.5%	2.7%
2011	0.1%	0.4%	1.0%	1.7%	2.8%
2012	0.1%	0.5%	1.2%	1.8%	3.0%
2013	0.2%	0.7%	1.3%	2.0%	3.1%
2014	0.2%	0.8%	1.5%	2.2%	3.3%
2015	0.3%	1.0%	1.8%	2.4%	3.4%
2016	0.4%	1.2%	2.0%	2.6%	3.6%
2017	0.6%	1.5%	2.3%	2.9%	3.8%
2018	0.9%	1.8%	2.6%	3.2%	3.9%
2019	1.3%	2.2%	3.0%	3.5%	4.1%
2020	1.8%	2.7%	3.4%	3.8%	4.3%
2021	2.5%	3.3%	3.8%	4.2%	4.5%
2022	3.5%	4.1%	4.4%	4.6%	4.8%
2023	5.0%	5.0%	5.0%	5.0%	5.0%
2024	7.1%	6.1%	5.7%	5.5%	5.2%
2025	10.0%	7.5%	6.5%	6.0%	5.5%
2026	14.1%	9.2%	7.4%	6.6%	5.8%
2027	20.0%	11.3%	8.5%	7.2%	6.1%
2028	28.3%	13.8%	9.6%	7.9%	6.3%
2029	40.0%	16.9%	11.0%	8.6%	6.7%
2030	56.6%	20.7%	12.5%	9.5%	7.0%
2031	80.0%	25.3%	14.3%	10.4%	7.3%
2032	113.1%	31.0%	16.3%	11.4%	7.7%
2033	160.0%	38.0%	18.6%	12.4%	8.1%
2034	226.3%	46.5%	21.2%	13.6%	8.4%
2035	320.0%	57.0%	24.1%	14.9%	8.9%
2036	452.5%	69.8%	27.5%	16.4%	9.3%
2037	640.0%	85.4%	31.4%	17.9%	9.7%
2038	905.1%	104.6%	35.8%	19.6%	10.2%
2039	1280.0%	128.1%	40.8%	21.5%	10.7%
2040	1810.2%	156.9%	46.5%	23.6%	11.2%
2041	2560.0%	192.2%	53.0%	25.8%	11.8%
2042	3620.4%	235.4%	60.5%	28.3%	12.4%
2043	5120.0%	288.3%	68.9%	31.0%	13.0%
2044	7240.8%	353.1%	78.6%	33.9%	13.6%
2045	10240.0%	432.5%	89.6%	37.2%	14.3%
2046	14481.5%	529.7%	102.2%	40.7%	15.0%
2047	20480.0%	648.7%	116.5%	44.6%	15.7%
2048	28963.1%	794.5%	132.8%	48.8%	16.5%
2049	40960.0%	973.1%	151.4%	53.5%	17.3%
2050	57926.2%	1191.8%	172.7%	58.6%	18.1%
2051	81920.0%	1459.6%	196.9%	64.2%	19.0%
2052	115852.4%	1787.7%	224.5%	70.3%	19.9%
2053	163840.0%	2189.5%	255.9%	77.0%	20.9%
2054	231704.8%	2681.5%	291.8%	84.4%	21.9%
2055	327680.0%	3284.2%	332.7%	92.4%	23.0%
2056	463409.5%	4022.3%	379.3%	101.3%	24.1%
2057	655360.0%	4926.3%	432.5%	110.9%	25.3%
2058	926819.0%	6033.5%	493.1%	121.5%	26.5%
2059	1310720.0%	7389.5%	562.3%	133.1%	27.8%
2060	1853638.0%	9050.2%	641.1%	145.8%	29.2%
2061	2621440.0%	11084.2%	731.0%	159.7%	30.6%
2062	3707276.0%	13575.3%	833.4%	175.0%	32.1%
2063	5242880.0%	16626.3%	950.2%	191.7%	33.6%
2064	7414552.0%	20363.0%	1083.4%	210.0%	35.3%
2065	10485760.0%	24939.4%	1235.3%	230.0%	37.0%
2066	14829104.0%	30544.4%	1408.5%	252.0%	38.8%
2067	20971520.0%	37409.1%	1605.9%	276.0%	40.7%
2068	29658208.0%	45816.7%	1831.0%	302.4%	42.7%
2069	41943040.0%	56113.7%	2087.7%	331.2%	44.8%
2070	59316416.0%	68725.0%	2380.3%	362.9%	47.0%
2071	83886080.0%	84170.6%	2714.0%	397.5%	49.2%
2072	118632832.0%	103087.5%	3094.4%	435.4%	51.7%
2073	167772160.0%	126255.8%	3528.2%	477.0%	54.2%
2074	237265664.1%	154631.2%	4022.8%	522.5%	56.8%
2075	335544320.0%	189383.8%	4586.7%	572.4%	59.6%
2076	474531328.1%	231946.8%	5229.6%	627.0%	62.5%
2077	671088640.0%	284075.6%	5962.7%	686.9%	65.5%
2078	949062656.2%	347920.2%	6798.5%	752.4%	68.7%
2079	1342177280.0%	426111.5%	7751.5%	824.2%	72.1%
2080	1898125312.5%	521880.3%	8838.0%	902.9%	75.6%
2081	2684354560.0%	639170.2%	10076.9%	989.1%	79.3%
2082	3796250625.0%	782820.4%	11489.4%	1083.5%	83.2%
2083	5368709120.0%	958755.3%	13100.0%	1186.9%	87.2%
2084	7592501249.9%	1174230.6%	14936.3%	1300.2%	91.5%
2085	10737418240.0%	1438132.9%	17030.0%	1424.3%	96.0%
2086	15185002499.9%	1761345.9%	19417.2%	1560.2%	100.7%
2087	21474836480.0%	2157199.4%	22139.0%	1709.1%	105.6%
2088	30370004999.8%	2642018.9%	25242.3%	1872.2%	110.7%
2089	42949672960.0%	3235799.1%	28780.7%	2050.9%	116.1%
2090	60740009999.5%	3963028.4%	32815.0%	2246.7%	121.8%
2091	85899345920.0%	4853698.7%	37414.8%	2461.1%	127.7%
2092	121480019999.0%	5944542.6%	42659.5%	2696.0%	134.0%
2093	171798691840.0%	7280548.0%	48639.3%	2953.3%	140.5%
2094	242960039998.1%	8916813.9%	55457.3%	3235.2%	147.4%
2095	343597383680.0%	10920822.0%	63231.1%	3544.0%	154.6%
2096	485920079996.2%	13375220.8%	72094.5%	3882.3%	162.1%
2097	687194767360.0%	16381233.1%	82200.4%	4252.8%	170.0%
2098	971840159992.3%	20062831.2%	93722.9%	4658.7%	178.3%
2099	1374389534720.0%	24571849.6%	106860.5%	5103.4%	187.0%
2100	1943680319984.7%	30094246.8%	121839.8%	5590.5%	196.2%

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